Review comments on a manuscript entitled “Implications of Mitigating the Ozone and Fine Particulate Matter Pollution in the Great Bay Area Using a Regional-to-Local Coupling Model” authored by Zhang etc.

General comments: Anthropogenic emissions and model resolutions are two important factors driving ambient air pollutant predictions. In this study, the authors proposed to use a coupled regional-to-street-scale air quality modeling system (i.e., CMAQ-ADMS) rather than a regional model to assess the impact of anthropogenic emissions on surface O3 and PM2.5 predictions. They suggested that a more stringent control strategy of VOC emissions, especially from industrial sector has the largest mitigation effect on ambient levels of O3 and frequency of O3 episodes in the Great Bay Area in China. Overall, the manuscript is well written and organized. However, more details of the model description and in-depth discussion are required. Please see the comments below.

Major comments.

1. The authors claimed that a coupled regional-to-local-scale modeling system was used in this study (Lines 45-46). Meanwhile, they pointed out that the CMAQ outputs were used to drive the ADMS-Urban dispersion model (L194-195). Thus, the term “coupled” is a little bit confused. I am not sure that CMAQ and ADMS are really coupled as an integrated modeling system or the only linkage between both is that the CMAQ outputs are used to drive the dispersion model runs. Some details on the “coupling” are necessary. Especially, a flow chart of the CMAQ-ADMS coupling system is helpful.
2. It is not clear how the ADMS-Urban dispersion model calculates the concentrations of gas-phase chemical species like O3 and NO2, and aerosol species like PM2.5. Does it include a gas-phase chemical mechanism for gas-phase species and an aerosol module for aerosol species predictions as CMAQ does? Or the ADMS model treats individual species as a tracer no matter it is gas or aerosol species? It will be helpful to provide a brief description on how the dispersion model predicts O3 since O3 is a secondary air pollutant and does not have emission sources.
3. Section 3.1: Why do the authors show the period-average prediction instead of daily maximum of 8-hr average O3 and 24-hr average PM2.5 during the simulation period? Does “period” represent two-month period? Is it possible to add a time series comparison rather than spatial patterns only between Base case and three sensitivities runs for the inner most domain or the regions rather than a location (Fig.10) only? The time series will help us to better understand how O3, PM2.5 and NO2 response to different emission control strategies during daytime, daytime, and on the days with and without episode cases.
4. Figure 1: Why did the authors only show simulated spatial patterns of NO2 for Base case and Half Traffic case but not for Half Industry VOC case? In addition, for the difference map, the authors only showed the between the case with Both Controls and Base case? I would suggest showing spatial pattern of simulations for the Base case and the difference maps between three sensitivity runs and the Base case individually.
5. Figures 2-3: It is suggested to combine both figures together. It will be better by showing spatial distribution map for the Base case, and difference maps between individual cases and Base case, like what you did for NO2 for consistency. The same suggestion should be suitable for PM2.5 (i.e., Figure 4).
6. It is surprised that no changes in O3 predictions are found over the Hong Kong region since all the sensitivity studies applied the emission reductions for the whole CMAQ domain 4 (see Fig.3). Any explanations on that?
7. Figures 5-7: The figures’ quality is not high. Please use English street name for the background map in all the figures. Please specify that all the replots were generated from the CMAQ or dispersion model simulations. It is better to add the locations of those three sites shown in Fig. 5 rather than Fig. S9 which can be deleted.
8. Section 3.3: Again, is it possible to compare their time series or period-average or monthly mean of diurnal patterns for a comparison?
9. Figure 8 shows a comparison of CMAQ- and ADMS-predicted daily maximum hourly NO2, daily maximum 8-hr average O3 and daily average PM2.5 at the three selected urban sites in Guangzhou. Please have a double check the location of the three sites and make sure they are in the inner most domain D4 (Figure S1) since the inner most domain (D4) of CMAQ only cover southern part of Guangzhou.
10. L17-18 and L50-52: It is not surprised, or it well known that ozone formation in an urban area is dominated by the VOC-limited regime. I do not think this is a new finding.
11. L142-144: If ADMS-Urban model considers street canyon effects that may improve air pollutants’ (e.g., O3 and PM2.5) predictions. I do not recall that the authors used this augment to interpret the model results and the comparisons with the regional model predictions.
12. L160-164: What I learned from here is, the authors used a regional model’s output with temporal and spatial variation rather than a constant measurement to drive the ADMS-Urban dispersion model. This can be considered as a major contribution of this study in terms of methodology effort(s). Can the authors further illustrate the improvement of ADMS-Urban predictions on street-level resolution by using a regional model output as the model inputs as compared to the case by using measurements as the model inputs?
13. L263-265: I am curious why you did not present total VOCs and anthropogenic VOCs?
14. L308 and L308: The statement of “lower oxidant emissions” (L308) has a conflict with “in less oxidant (in this case, O3)” since O3 does not have emissions.
15. L291-318: The authors seem to simply repeat the discussion of Figure 1 for that of Figures 2-4. Some in-depth analyses are required.
16. Figures 8, 9 and 10: Can you use statical parameters to verify the model performance and then quantify the differences between the Base case and sensitivity runs?
17. Figure 10: Is it possible to include the dispersion model predictions in the time series for a comparison? That may further illustrate the advantage of the high-resolution or street-level scale model results as compared to the regional model predictions.
18. L450: It is strange that a VOC-limited regime was identified near a rural area downwind. Do you have any idea on that? Or what is the indication to your study?
19. I want to know what the difference between “Discussion” and “Conclusion” parts is. To me, the former is just a summary of this study, I do not get additional points or indication from this discussion.
20. L505-506: It seems that the street-scale ADMS0-Urban model shows an improvement in capturing a sharp concentration gradient near traffic streams spatially. What about improvement in terms of temporal variation? Did the authors get a chance to do such a temporal comparison?
21. Figures S2: Why do you present emission comparisons using the unit of KT/year while other figures (Fig.S3-S8) use different units with g or mole per second? Is it possible to make them be consistent?

Minor comments or technique issues

1. Lines 87-90: I do not think this sentence has a direct implication on this study.
2. L127-129: Any reference(s) for this?
3. L145: Please define the H/W ratio(s)?
4. L155: ADMS should be defined at the first time when it was used.
5. L178-182: You should move them to reference review in Introduction Section.
6. L272: I cannot find the locations of Shengzhen, Dongguan, and Guangzhou in any of the figures. This will be difficult to the readers who are not familiar with those cities.
7. L273-274: The statement of “The reduction in VOC has no effects on NOx and PM2.5 emissions” is meaningless.
8. Figure 9 and L395: where is “a rural site”? Can you add the location of the rural site in Figure 1?
9. Figure 10 and L424: Where is “a location to the north-east of the model main”? Can you add it to Figure 1?